What is claimed is:

1. A periodic signal controller for generating a periodic AC output signal synchronized with a periodic AC input signal, comprising:

a first sine-wave signal generation circuit for outputting a first sine-wave signal with a frequency varied according to a first command signal;

a first phase difference detection circuit for detecting a phase difference between the AC input signal and the first sine-wave signal output from said first sine-wave signal detection circuit and then outputting the first command signal indicating the phase difference;

a second sine-wave signal generation circuit for outputting a second sine-wave signal as the AC output signal, the second sine-wave signal having a frequency varied according to a second command signal;

a second phase difference detection circuit for detecting a phase difference between the first sine-wave signal output from said first sine-wave signal generation circuit and the second sine-wave signal output from said second sine-wave signal generation circuit and then outputting a phase difference detection signal indicating the phase difference;

a frequency difference detection circuit for detecting a frequency difference between the first sine-wave signal output from said first sine-wave signal generation circuit and the second sine-wave signal output

from said second sine-wave signal generation circuit and then outputting a frequency difference detection signal indicating the frequency difference;

an adder circuit for adding the phase difference detection signal output from said second phase difference detection circuit to the frequency difference detection signal output from said frequency difference detection circuit; and

a frequency variation rate limiter circuit for receiving an output of said adder circuit and outputting to said second sine-wave signal generation circuit the second command signal for limiting a frequency variation rate of the second sine-wave signal to a fixed value or less and synchronizing the second sine-wave signal with the AC input signal;

wherein said first phase difference detection circuit and said first sine-wave signal generation circuit constitute a phase-locked loop.

2. The periodic signal controller as claimed in claim 1, further comprising:

a frequency anomaly detection circuit for determining whether the AC input signal has a frequency anomaly or not; and

a switching circuit for preventing the output of said adder circuit from being input to said frequency variation rate limiter circuit and causing said frequency variation

rate limiter circuit to output as the second command signal a forcing command signal for gradually matching a frequency of the second sine-wave signal to a predetermined reference frequency when said frequency anomaly detection circuit detects the frequency anomaly.

3. The periodic signal controller as claimed in claim 2, wherein said frequency variation rate limiter circuit comprises:

a limiter for limiting an amount of frequency variation required for synchronization of the AC output signal to the AC input signal to a predetermined upper value; and

an integrator for integrating an output of said limiter, thereby outputting a frequency value required for the synchronization; and

said frequency anomaly detection circuit comprises a determination circuit for determining the frequency anomaly when a sum of the frequency value output from said integrator and the reference frequency for the AC input signal exceeds a predetermined reference value for frequency anomaly detection.

4. A periodic signal controller for generating a periodic single-phase AC output signal synchronized with a periodic single-phase AC input signal, comprising:

a first sine-wave and cosine-wave signal generation

circuit for outputting a first sine-wave signal and a first cosine-wave signal with respective frequencies thereof varied according to a first command signal;

a first phase difference detection circuit for detecting a phase difference between the single-phase AC input signal and the first sine-wave signal and then outputting the first command signal indicating the phase difference, said first phase difference detection circuit comprising a multiplier for multiplying the AC input signal by the first cosine-wave signal output from said first sine-wave and cosine-wave signal generation circuit and a low-pass filter for removing from an output of said multiplier a frequency component having an angular frequency twice the angular frequency of the single-phase AC input signal;

a second sine-wave and cosine-wave signal generation circuit for generating a second sine-wave signal and a second cosine-wave signal with respective frequencies thereof varied according to a second command signal and outputting the second sine-wave signal as the single-phase AC output signal;

a frequency difference detection circuit for computing a frequency difference between the AC input signal and the AC output signal from instantaneous values of the first sine-wave and cosine-wave signals output from said first sine-wave and cosine-wave signal generation circuit and the second sine-wave and cosine-wave signals

output from said second sine-wave and cosine-wave signal generation circuit and then outputting a frequency difference detection signal indicating the frequency difference;

a second phase difference detection circuit for receiving the instantaneous values of the first sine-wave and cosine-wave signals output from said first sine-wave and cosine-wave signal generation circuit and the second sine-wave and cosine-wave signals output from said second sine-wave and cosine-wave signal generation circuit, computing a phase difference between the first sine-wave signal and the second sine-wave signal, and then outputting a phase difference detection signal indicating the phase difference;

an adder circuit for adding the phase difference detection signal output from said second phase difference detection circuit to the frequency difference detection signal output from said frequency difference detection circuit; and

a frequency variation rate limiter circuit for receiving an output of said adder circuit and outputting to said second sine-wave and cosine-wave signal generation circuit the second command signal for limiting a frequency variation rate of the second sine-wave signal to a fixed value or less and synchronizing the second sine-wave signal with the AC input signal;

wherein said first phase difference detection

circuit and said first sine-wave and cosine-wave signal generation circuit constitute a phase-locked loop.

5. The periodic signal controller as claimed in claim 4, further comprising:

a frequency anomaly detection circuit for determining whether the AC input signal has a frequency anomaly or not; and

a switching circuit for preventing the output of said adder circuit from being input to said frequency variation rate limiter circuit and causing said frequency variation rate limiter circuit to output as the second command signal a forcing command signal for gradually matching a frequency of the second sine-wave signal to a predetermined reference frequency when said frequency anomaly detection circuit detects the frequency anomaly.

6. The periodic signal controller as claimed in claim 5, wherein said frequency variation rate limiter circuit comprises:

a limiter for limiting an amount of frequency variation required for synchronization of the AC output signal to the AC input signal to a predetermined upper value; and

an integrator for integrating an output of said limiter, thereby outputting a frequency value required for the synchronization; and

said frequency anomaly detection circuit comprises a determination circuit for determining the frequency anomaly when a sum of the frequency value output from said integrator and the reference frequency for the AC input signal exceeds a predetermined reference value for frequency anomaly detection.

7. The periodic signal controller as claimed in claim 5, wherein said frequency anomaly detection circuit comprises:

an input frequency detection circuit for receiving the first sine-wave and cosine-wave signals output from said first sine-wave and cosine-wave signal generation circuit, and then computing an input frequency f ($\approx f_s$) based on a formula

$$f_s=\{\sin(\omega_s\cdot t_n)\cdot\cos(\omega_s\cdot t_{n-1})-\cos(\omega_s\cdot t_n)\cdot\sin((\omega_s\cdot t_{n-1})\}/2\pi t_s$$

in which t_n indicates an nth sampling time, t_{n-1} indicates an (n-1)th sampling time, an angular frequency ω_s indicates $2\pi f_s$, in which f_s indicates a frequency of each of the first sine-wave signal and the first cosine-wave signal output from said first sine-wave and cosine-wave signal generation circuit, t_s indicates a sampling period of time, and an input signal of said first sine-wave and cosine-wave signal generation circuit is synchronized with an output signal of said first sine-wave and cosine-wave signal generation circuit at high speed; and

a determination circuit for comparing the input

from said first sine-wave and cosine-wave signal generation circuit (2'), t_s indicates a sampling period of time, and an input signal of said first sine-wave and cosine-wave signal generation circuit (2') is synchronized with an output signal of said first sine-wave and cosine-wave signal generation circuit (2') at high speed; and

a determination circuit (14b) for comparing the input frequency determined by said input frequency detection circuit (14a) with a predetermined reference value for frequency anomaly detection to determine the frequency anomaly when the input frequency exceeds the predetermined reference value for frequency anomaly detection.

8. A periodic signal controller for generating a periodic three-phase AC output signal synchronized with a periodic three-phase AC input signal, characterized in that said periodic signal controller comprises:

a three-to-two phase transformation circuit (15) for converting the three-phase AC input signals to two phase signals and then outputting a phase-transformed sine-wave signal and a phase-transformed cosine-wave signal;

a first sine-wave and cosine-wave signal generation circuit (2') for outputting a first sine-wave signal and a first cosine-wave signal with respective frequencies thereof varied according to a first command signal;

a first phase difference detection circuit (1') for

phase difference as the first command signal;

a second sine-wave and cosine-wave signal generation circuit for generating a second sine-wave signal and a second cosine-wave signal with respective frequencies thereof varied according to a second command signal and generating the three-phase AC output signal with a frequency thereof varied according to the second command signal, the three-phase AC output signal including the second sine-wave signal;

a frequency difference detection circuit for computing a frequency difference between the AC input signal and the AC output signal using instantaneous values of the first sine-wave and cosine-wave signals output from said first sine-wave and cosine-wave signal generation circuit and the second sine-wave and cosine-wave signals output from said second sine-wave and cosine-wave signal generation circuit, and then outputting a frequency difference detection signal indicating the frequency difference;

a second phase difference detection circuit for receiving the instantaneous values of the first sine-wave and cosine-wave signals output from said first sine-wave and cosine-wave signal generation circuit and the second sine-wave and cosine-wave signals output from said second sine-wave and cosine-wave signal generation circuit, computing a phase difference between the first sine-wave signal and the second sine-wave signal, and then

outputting a phase difference detection signal indicating the phase difference;

an adder circuit for adding the phase difference detection signal output from said second phase difference detection circuit to the frequency difference detection signal output from said frequency difference detection circuit; and

a frequency variation rate limiter circuit for receiving an output of said adder circuit and then outputting to said second sine-wave and cosine-wave signal generation circuit the second command signal for limiting a frequency variation rate of the second sine-wave signal to a fixed value or less and synchronizing the second sine-wave signal to the AC input signal;

wherein said first phase difference detection circuit and said first sine-wave and cosine-wave signal generation circuit constitute a phase-locked loop.

9. The periodic signal controller as claimed in claim 8, further comprising:

a frequency anomaly detection circuit for determining whether the AC input signals have a frequency anomaly or not; and

a switching circuit for preventing the output of said adder circuit from being input to said frequency variation rate limiter circuit and causing said frequency variation rate limiter circuit to output as the second command signal

a forcing command signal for gradually matching a frequency of the second sine-wave signal to a predetermined reference frequency when said frequency anomaly detection circuit detects the frequency anomaly.

10. The periodic signal controller as claimed in claim 9, wherein said frequency variation rate limiter circuit comprises:

a limiter for limiting an amount of frequency variation required for synchronization of the AC output signal to the AC input signal to a predetermined upper value; and

an integrator for integrating an output of said limiter, thereby outputting a frequency value required for the synchronization; and

said frequency anomaly detection circuit comprises a determination circuit for determining the frequency anomaly when a sum of the frequency value output from said integrator and the reference frequency for the AC input signals exceed a predetermined reference value for frequency anomaly detection.

11. The periodic signal controller as claimed in claim 9, wherein said frequency anomaly detection circuit comprises:

an input frequency detection circuit for receiving the first sine-wave and cosine-wave signals output from

said first sine-wave and cosine-wave signal generation circuit, and then computing an input frequency f ($\approx f_s$) based on a formula

$$f_s=\{\sin(\omega_s \cdot t_n)\cdot\cos(\omega_s \cdot t_{n-1})-\cos(\omega_s \cdot t_n)\cdot\sin((\omega_s \cdot t_{n-1})\}/2\pi t_s$$

in which t_n indicates an nth sampling time, t_{n-1} indicates an (n-1)th sampling time, an angular frequency ω_s indicates $2\pi f_s$, in which f_s indicates a frequency of each of the first sine-wave signal and the first cosine-wave signal output from said first sine-wave and cosine-wave signal generation circuit, t_s indicates a sampling period of time, and an input signal of said first sine-wave and cosine-wave signal generation circuit is synchronized with an output signal of said first sine-wave and cosine-wave signal generation circuit at high speed; and

a determination circuit for comparing the input frequency determined by said input frequency detection circuit with a predetermined reference value for frequency anomaly detection to determine the frequency anomaly when the input frequency exceeds the predetermined reference value for frequency anomaly detection.

12. A frequency detection device comprising:

a sine-wave and cosine-wave signal generation circuit for generating a sine-wave signal and a cosine-wave signal synchronized with an AC input signal to be measured; and

an input frequency detection circuit for receiving

the sine-wave and cosine-wave signals and then computing an input frequency $f_{\cdot}$ ($\approx f_s$) based on a formula $f_s=\{\sin(\omega_s \cdot t_n)\cdot\cos(\omega_s \cdot t_{n-1})-\cos(\omega_s \cdot t_n)\cdot\sin((\omega_s \cdot t_{n-1})\}/2\pi t_s$ in which t_n indicates an nth sampling time, t_{n-1} indicates an (n-1)th sampling time, an angular frequency ω_s indicates $2\pi f_s$, in which f_s indicates a frequency of each of the sine-wave signal and the first cosine-wave signal output from said first sine-wave and cosine-wave signal generation circuit, t_s indicates a sampling period of time, and an input signal of said sine-wave and cosine-wave signal generation circuit is synchronized with an output signal of said sine-wave and cosine-wave signal generation circuit at high speed.